tances across wide areas are measured is necessary for the determination of the size. The shape and size of the earth have already been determined a number of times but in each case the data used covered only a comparatively small part of the earth's surface. With more extensive data over greater areas closer approximations to the true figure of the earth can be made.

The shape and size of the earth are needed in all surveying and mapping operations which are executed on a large scale, in navigation, and in explorations. The figure of the earth is needed as well as the distances between widely separated points in connection with certain astronomical observations, especially in the determination of the parallax of the moon.

It has been found that the combination of astronomical and triangulation data enable one to learn much in regard to deviations from normal density in the outer portion of the earth. In fact it is by means of astronomical and triangulation data that the first comprehensive quantitative test of isostasy was made. It was found that the material under continental areas is lighter than normal while the material under ocean areas is heavier than normal. The deviations from normal density were found to be sufficient to balance the topographic features. This condition of balance or equilibrium of prisms of the earth's crust is called isostasy.

While the application of the principle of isostasy to triangulation and astronomical data brought these data into very close agreement it was found that there were some outstanding differences. Further investigation in the field of isostasy involving values of gravity led to the rather definite conclusion that the abnormalities or residuals in the geodetic data resulted from the presence of extra heavy or extra light material near the geodetic stations, both horizontally and vertically. It seems to be reasonably certain that the deflections of the vertical, as differences between triangulation and astronomical data are called, can be used for the purpose of disclosing buried structure. There is now available in the United States a large amount of geodetic data in the form of deflections of the vertical which can be used in connection with geological studies.

Now that isostasy has been substantiated as a scientific principle we are able to use triangulation and astronomical data to show the deviations of the geoid or water surface of the earth from the spheroid or mathematical surface which most nearly fits the geoid. A surface can be passed through the astronomical stations at right angles to the direc-

tion of gravity and also through the derived directions of gravity at places where triangulation has not been executed or astronomical observations made, but where the deflection of the vertical on the isostatic principle has been computed. What might be called a geoid contour map could be constructed which would show the deviations of the geoid from the spheroid.

One of the most notable cases of the use of triangulation in a scientific problem was the measurement, by means of a base and triangulation, of the distance between San Antonio Peak and Mt. Wilson in southern California for the use of Prof. A. A. Michelson in the determination of the velocity of light. The length of the base was about 22 miles while the distance between the two peaks was about 23 miles. Every possible correction was applied to the triangulation in order to eliminate the effect of systematic errors. The base line was measured with a probable error of about one part in 10 million, while the probable error of the distance between the two peaks was about one part in 6 million. It seems reasonably certain that the distance furnished Prof. Michelson was not in error by as much as one millionth of the distance.

Triangulation has been used in this and other countries in the determination of the distortion of the earth's surface during earthquakes. Already rather extensive investigations have been made in California by means of triangulation, and plans are now being formulated for an extension of the tests. Arcs of triangulation are being extended across areas where there are fault zones which have been active in historical or at least in late geological time. It is planned to have this triangulation repeated at intervals of ten or some other number of years to see if any strains have taken place in the earth's material. Should an earthquake occur along any of the faults or in fact anywhere in the vicinity of this triangulation the work will be repeated in order to learn how much movement of the ground had occurred at different distances from the fault, and how far from the fault one must go in order to find undisturbed points. These tests by triangulation in regions of seismic activity are of particular importance to the geologist for by them he can obtain an idea as to whether an earthquake is a local or a general phenomenon.

The Coast and Geodetic Survey has in the last few years made a readjustment of the triangulation net of the western half of the United States involving about 13,000 miles of arc. The bureau is now engaged in the computation and adjustment of the net of the eastern half of the country. The latter work will be completed in the next two or three